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Lactarius vesterholtii, a new species from India

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Abstract — *Lactarius vesterholtii* is proposed as new to science. It is characterized by a greyish brown dry subvelutinous pileus, very crowded light yellow lamellae turning orange when bruised, white copious latex becoming reddish orange in contact with the lamellae, a light yellow spore print, amyloid basidiospores ornamented with high ridges that forms an incomplete reticulum, the absence of pleuro- and cheilomacrocystidia, a trichopalisade to lamprotrichopalisade-type pileipellis, and a palisade to lampropalisade-type stipitipellis. The new species is compared with allied Asian and extralimital taxa. A key to the Indian taxa of *L.* subg. *Plinthogali* is also provided.

Key words — macrofungi, *Plinthogali*, *Russulaceae*, Sikkim, taxonomy

Introduction

Lactarius subg. *Plinthogali* (Burl.) Hesler & A.H. Sm., one of the well established groups amongst the common milkcaps [*Lactarius* Pers. and *Lactifluus* (Pers.) Roussel], is characterized by a pileus that is dry, velutinous to velvety, and white to buff, brownish to grey or blackish; distant to crowded lamellae; a stipe that is mostly concolorous with the pileus; context or latex in contact with the context mostly changing pinkish to reddish; a spore print that is buff, pale yellow, ochraceous, or darker but never white; basidiospores ornamented mostly with high ridges or warts either arranged in a parallel/zebroid pattern or aligned and connected in a broken to complete reticulum; macrocystidia mostly absent; and a pileipellis that is a palisade, trichopalisade, or trichoderm (Basso 1999, Das & Sharma 2004, Stubbe et al. 2008). A closely related group, *Lactifluus* subg. *Gerardii* (A.H. Sm. & Hesler) Stubbe [≡ *Lactarius* subg. *Gerardii*], can be distinguished by a white spore print and more rounded cellular elements in a palisade-type pileipellis (Stubbe et al. 2010, Verbeken & Nuytinck 2013). Ten taxa are known from *Lactarius* subg. *Plinthogali*

in India: *L. subvernalis* var. *himalayensis* Atri et al., *L. subvernalis* var. *alboochraceus* Hesler & A.H. Smith, *L. crenulatus* K. Das & Verbeken, *L. fuliginosus* (Fr.) Fr. [= *L. fumosus* Peck], *L. picinus* Fr., *L. montoyae* K. Das & J.R. Sharma, *L. lignyotellus* A.H. Sm. & Hesler, *L. croceigalus* K. Das & Verbeken, *L. lignyotus* Fr. var. *lignyotus,* and *L. lignyotus* var. *canadensis* A.H. Sm. & Hesler (Atri et al. 1993, 1994; Das & Sharma 2005; Das & Verbeken 2012).

A number of interesting ectomycorrhizal mushrooms were collected during a recent macrofungal exploration of the North district of Sikkim Himalaya. Detailed examination of the collections resulted in the discovery of a new species within *Lactarius* subg. *Plinthogali,* proposed here as *Lactarius vesterholtii*.

Materials & methods

Macromorphological features were recorded from the fresh basidiomata in the field and base camp. Macrochemical reactions with KOH, $FeSO_4$ and Guaiacol were noted. Basidiomata were dried with a field drier. Fresh and dry basidiomata were photographed using Nikon D300s, Olympus C-5060, Leica DFC550, and Nikon-DS-Ni1 cameras. Color codes and terms used are mostly from Kornerup & Wanscher (1978). Micromorphological characters were recorded with the help of compound microscope (Nikon Eclipse Ni-U) from free hand sections of dry samples mounted in a mixture of 5 % KOH and Phloxine, 30 % glycerol, and Melzer's reagent. Drawings were made with a drawing tube attached to an Olympus CX41 microscope (1000×). Basidium length excludes length of sterigmata. Basidiospore measurements and features were noted in side view from twenty basidiospores. Spore measurements and length/width ratios (Q) are presented as minimum–**mean**–maximum. Herbarium name follows Holmgren et al. (1990).

Taxonomy

Lactarius vesterholtii K. Das & D. Chakr., **sp. nov.** Plates 1, 2

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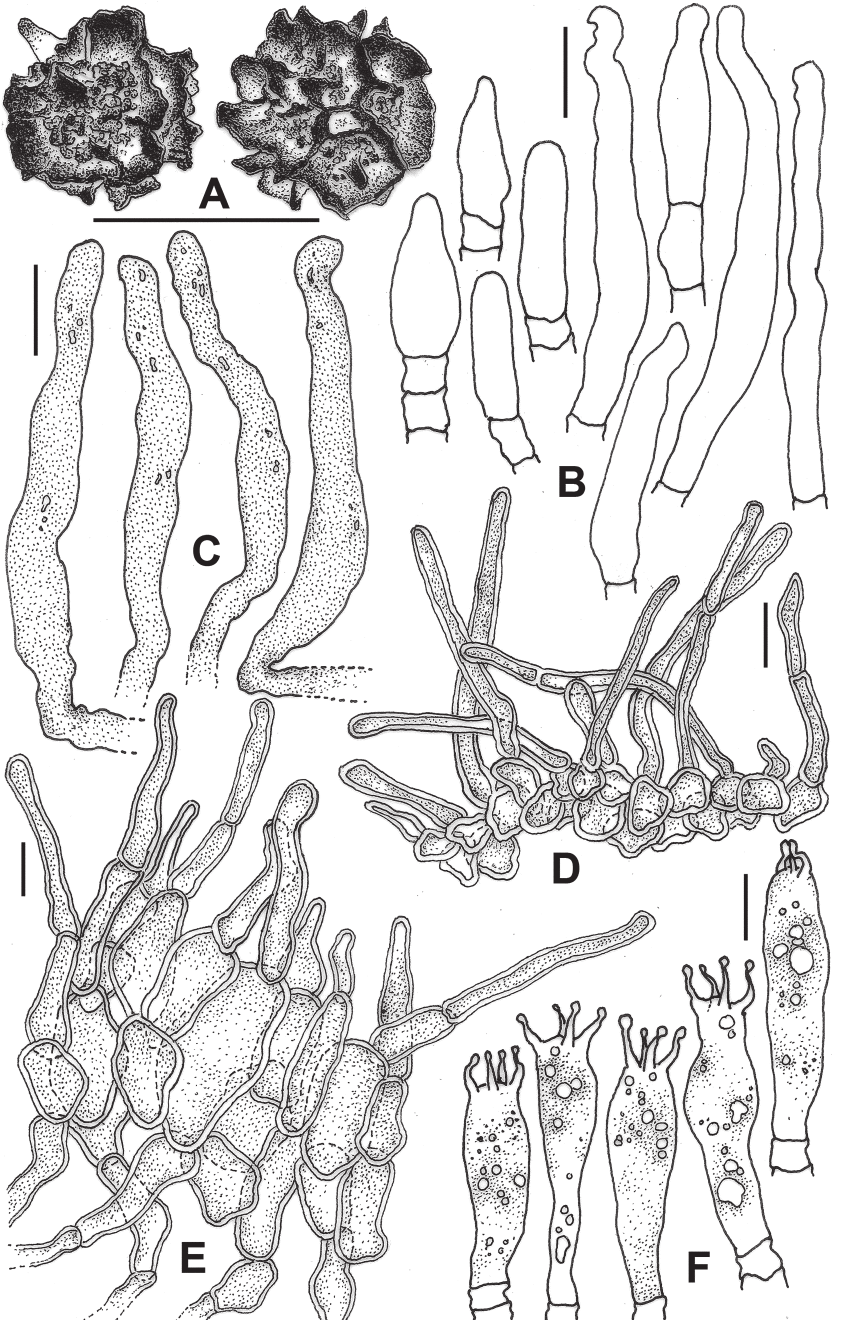
Differs from *Lactarius montoyae* by its very crowded lamellae and smaller reticulate basidiospores and from *L. croceigalus* by its very crowded light yellow lamellae that turn light orange to orange when bruised, its unbranched pleuropseudocystidia, and its lack of pileopseudocystidia.

Type: India. Sikkim: North District, Bansoi, 27°41′56.2″N 88°34′10.6″E, alt. 2323 m, 31.VII.2013, K. Das, KD-13-84 (**Holotype**, CAL).

Etymology: in recognition of the late Dr. Jan Vesterholt (Denmark) for his contribution to the family *Russulaceae*

Pileus 58–75 mm diam., convex when young, becoming planoconvex to shallowly depressed or slightly infundibuliform, never umbonate; surface rough

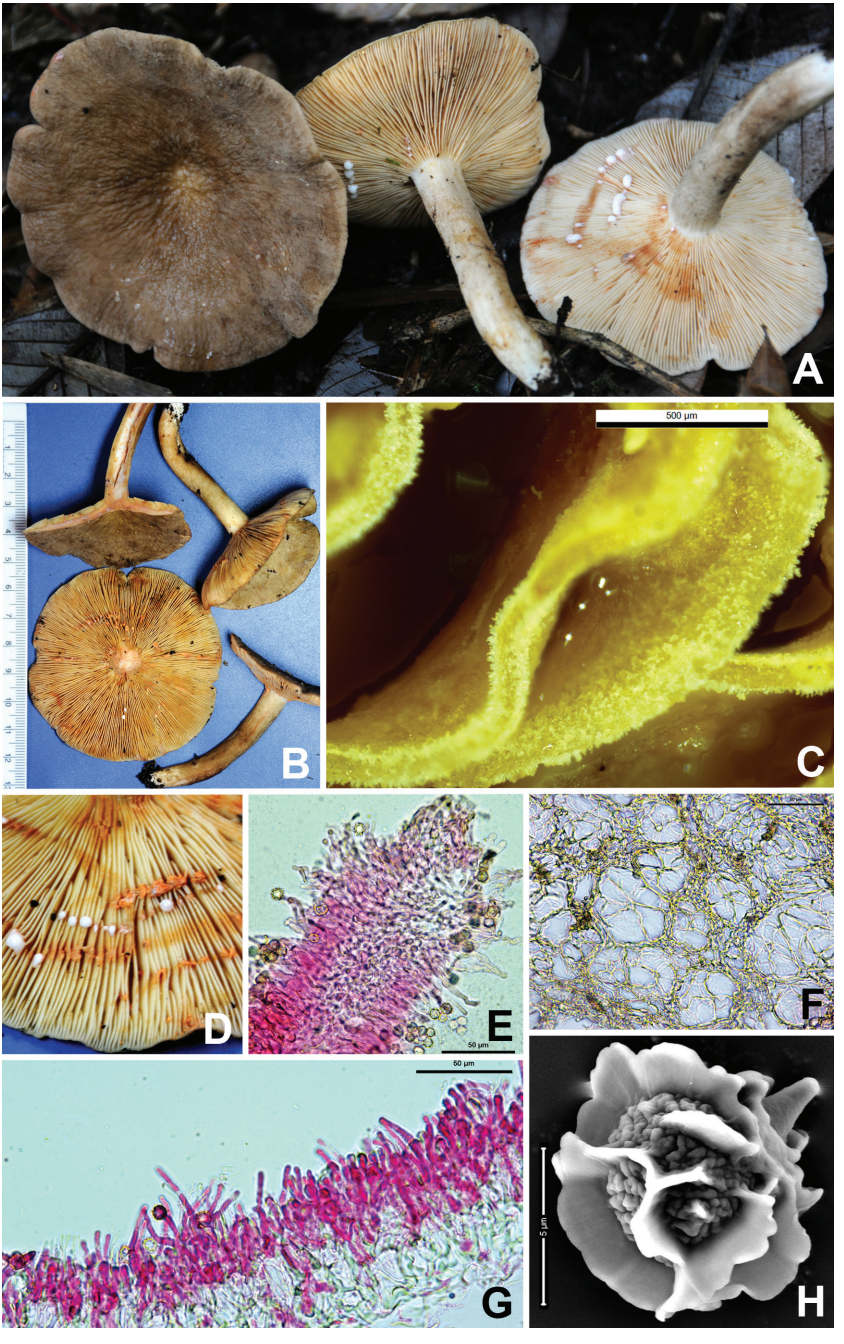
Plate 1. *Lactarius vesterholtii* (KD 13-84, holotype). A. Basidiospores; B. Cheiloleptocystidia; C. Pleuropseudocystidia; D. Cross-section through stipitipellis; E. Cross-section through pileipellis; F. Basidia. Scale bars = 10 μm.


A
B
C
D
E
F

to subvelutinous, mostly radially wrinkled, dry to moist, never viscid, light brown (6D4) to greyish brown (6D3) or sometimes pale yellow (4A3) to greyish yellow (4B3); margin decurved to incurved, irregularly wavy or interrupted at maturity. Lamellae narrowly adnate to subdecurrent, very crowded (23/cm at pileus-margin), brittle, light yellow (4A4), turning light orange (5A5) to orange (5A7) when bruised; edge smooth but, minutely hairy (under stereo-zoom microscope), concolorous; lamellulae abundant, in 7–8 series. Stipe 55–75 × 8–13 mm, central, more or less cylindrical with tapering base; surface more or less smooth, yellowish white (4A2) at apex, towards base greyish orange (5B3) to brownish orange (5C4) or concolorous to pileus, then paler to pale yellow (4A3) near base and finally white at base, turning light orange (5A5) when bruised. Context white, becoming pale yellow (4A3), light orange (5A4) or darker when exposed, turning pale orange (5A3) with $FeSO_4$, reddish brown (8D7) with guaiacol and yellowish white (1A2) to pale yellow (1A3) with KOH. Latex abundant, white, unchanging when kept isolated, turning yellowish white with KOH but, on contact with the cut lamellae becoming pinkish white (7A2) after 3–4 minutes, then finally (or after drying) reddish orange (7A6). Odor indistinctive. Taste slightly sour initially, then acrid. Spore print light yellow (4A4).

Basidiospores 7.0–**7.5**–8.5 × 6.5–**7.1**–8.0 µm (n = 20, Q = 1.00–**1.05**–1.14), globose to subglobose; ornamentation amyloid, composed of high ridges or wings (up to 2.3 µm high) with remarkably and irregularly crenulate to lobed margin which aligned or connected to form broken to incomplete or almost complete reticulum, few high isolated subspinoid warts and isolated to jointed conical to irregular numerous minute warts (often in convoluted pattern) between high ridges; plage mostly distally amyloid. Basidia 31–53 × 8–12 µm, 4-spored, narrowly clavate to clavate, subcylindric to subclavate or ventricose; sterigmata 5–8 × 1.5–2 µm. Pleuromacrocystidia absent. Pleuropseudocystidia 4.5–7.5 µm wide, fairly common, cylindrical to subcylindrical with somewhat tortuous base, content slightly dense. Lamella-edge sterile. Cheilomacrocystidia absent. Cheiloleptocystidia 17–58 × 5–8 µm, abundant, cylindrical to subfusoid with rounded or subcapitate apex, sometimes tortuous towards apex, emergent to 35 µm, often septate, hyaline in KOH, never with brown pigmentation. Cheilopseudocystidia absent. Subhymenium layer 13–23 µm thick, pseudoparenchymatous, composed of irregular cells of 7–14.3 × 4–11 µm. Hymenophoral trama with some lactifers.

Plate 2. *Lactarius vesterholtii* (KD 13-84, holotype). A, B. Fresh basidiomata; C. Lamellar edge under stereo-zoom microscope; D. White latex turning reddish orange on cut lamellae; E. Lamellar edge, cross-section; F. Sphaerocyst nest in stipe trama; G. Pileipellis, radial section; H. Basidiospore (SEM). Scale bars: C = 0.5 mm; E–G = 50 µm; H = 5 µm.


A
B
500 µm
C
D
E
50 µm
F
50 µm
G
5 µm
H

Pileipellis 84–120 µm, two layered (supra- and subpellis), trichopalisade to lamprotrichopalisade, pileopseudocystidia absent. Suprapellis composed of thick-walled hair-like erect often septate hyphal elements; terminal cells 13–53 × 4–7.5 µm, cylindrical, ventricose, subfusoid, clavate or irregular with rounded to subcapitate apex, brown to grey pigmented, wall 0.8–1.3 µm thick. Subpellis composed of somewhat compact oval, ellipsoid to elongate or irregular thick-walled (up to 1.5 µm thick) cells with brown to grey pigmentation. Pileus trama composed nests of sphaerocytes and surrounding branched septate hyphae (4–8 µm wide). Stipitipellis up to 110 µm thick, two layered, palisade to lampropalisade. Suprapellis composed of thick-walled hair-like erect often septate hyphal elements; terminal cells 8–60 × 4–7 µm, brown-pigmented, mostly cylindrical with subfusoid to subcapitate or rounded apex. Subpellis mostly of thick-walled isodiametric brown pigmented cells. Stipe trama composed of numerous nests of sphaerocysts and hyphae.

Ecology & Distribution — Gregarious to caespitose, in temperate mixed (broad-leaf & coniferous) forest under *Lithocarpus pachyphyllus* (Kurz) Rehder. July. Rare.

Notes — The combination of features, such as the brown to greyish brown subvelutinous pileus, white latex turning pinkish white to reddish orange, globose to subglobose highly ornamented winged spores, absence of macrocystidia, and the trichopalisade pileipellis, places this species in subg. *Plinthogali*. Its very crowded lamellae, emarginate lamellar edge, sour to acrid taste, spores with combination of high wings and numerous minute warts, abundant cheiloleptocystidia, and lack of pileocystidia makes it distinct among the known taxa of this subgenus.

Lactarius montoyae (reported from India and Thailand), *L. croceigalus* (reported from India), and *L. crassiusculus* H.T. Le & Stubbe (reported from Thailand) are some Asian species that invite comparison with *L. vesterholtii*. *Lactarius montoyae* is distinguished by its distant (4/cm) lamellae, unchanging latex, ochraceous to orange-yellow spore print, and larger (7.5–10 × 7.3–9.3 µm) non-reticulate spores (Das & Sharma 2004, Le et al. 2007). *Lactarius croceigalus* can be separated by its distant (6/cm) lamellae, which are unchanging on bruising, the possession of pileopseudocystidia, and branched pleuropseudocystidia (Das & Verbeken 2012). *Lactarius crassiusculus* has close lamellae, abundant cheilomacrocystidia, a palisade pileipellis, and trichoderm-type stipitipellis (Le et al. 2007).

Lactarius acris (Bolton) Gray and *L. pterosporus* Romagn. are two superficially similar European species. However, *L. acris* is characterized by distinctly viscid to sticky pileus, latex turning coral-pink even when isolated from

lamellar tissues, and an ixotrichoderm- or ixotrichopalisade-type pileipellis; *L. pterosporus* can be separated by a stipe that is never concolorous with the pileus, a mild (never acrid) taste, and spiral to parallel spore-ornamentation.

Including *Lactarius vesterholtii*, *Lactarius* subg. *Plinthogali* is now represented by 11 taxa from India. A key is provided below for their easy identification.

Key to the identification of taxa of *Lactarius* subg. *Plinthogali* in India

1. Spore-ornamentation <1.5 µm 2
1. Spore-ornamentation >1.5–2.7 µm. 6
2. Pleuromacrocystidia present 3
2. Pleuromacrocystidia absent 4
3. Latex does not fade to yellowish after turning carrot red; wide spore range (6.4–9.7 × 5.6–8 µm); basidia longer (40.3–68.4 × 7–16 µm) ..... *L. subvernalis* var. *himalayensis*
3. Latex fades to yellowish after turning carrot red; spore range narrow (6.9–7.7 × 5.4–7.2 µm); basidia shorter (37–48 × 8–11 µm) ..... *L. subvernalis* var. *albo-ochraceus*
4. Pileus small (< 30 mm); stipe narrow. ..... *L. crenulatus*
4. Pileus large (>30 mm); stipe wide 5
5. Pileus yellow-brown to whitish; spore print pinkish buff; context salmon when exposed ..... *L. fuliginosus*
5. Pileus dark grey-brown to blackish brown; spore print bright ocher; context pale reddish brown when exposed ..... *L. picinus*
6. Spore ornamentation never reticulate, of parallel wings >2.5 µm high. . . *L. montoyae*
6. Spore ornamentation a partial to incomplete reticulum, always <2.5 µm high 7
7. Latex white, unchanging and not staining lamellae ..... *L. lignyotellus*
7. Latex white, turning lamellae pinkish to yellowish pink or saffron 8
8. Lamellar edge emarginate, unchanging or becoming orange after bruising; pileopseudocystidia present or absent; spore-ornamentation ≤2.3 µm high ... 9
8. Lamellar edge emarginate or marginate, but not with the above combination of characters 10
9. Lamellae distant, unchanging after bruising; context unchanging with guaiacol; spore print ochraceous; pileopseudocystidia present ..... *L. croceigalus*
9. Lamellae very crowded, becoming orange after bruising; context reddish brown with guaiacol; spore print light yellow; pileopseudocystidia absent ..... *L. vesterholtii*
10. Lamellae emarginate, lamellar edge concolorous with the surface; stipe stuffed; found under *Quercus*, *Rhododendron* association ..... *L. lignyotus* var. *lignyotus*
10. Lamellae marginate, lamellar edge brownish black; stipe always hollow; found under *Abies*, *Picea* association ..... *L. lignyotus* var. *canadensis*

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